enclosed, which shows that adding conventional cross-hatching makes the drawing more difficult to read.

The specification has been amended to add the continuity information as requested. Also, the title and abstract have been amended to point out that the invention is directed to the product rather than to a method.

Claims 10-18 have been rejected under 35 USC 102 (b) as anticipated by Ito et al (Ito). The Ito patent describes a printed wiring board which is structurally different from that of the Applicants and which is made by a different method. As amended, the claims now are clearly distinguished from the printed wiring boards of Ito. Claims 10 and new Claim 19 require that the outer wiring patterns have a copper layer over a layer of an alkaline refractory (i.e. resistant) metal, which is adjacent to a thermosetting resin layer. Ito lacks the alkaline refractory metal layer. Furthermore, the vias made by laser drilling through a the alkaline refractory metal layer and the thermosetting resin layer no longer contain the alkaline refractory metal and the copper deposited on the vias is directly on the thermosetting resin layer. The method and product of the Applicants is clearly shown in Fig.1(a) and Fig.2(a). Before forming the outer wiring patterns an inner wiring board 4 and 5 is laminated with a copper foil 1, which has had a thin layer of an alkaline refractory metal 2 deposited on it, followed by a layer of a thermosetting resin 3. The copper layer 1 is etched away, leaving the alkaline refractory metal exposed (Fig. 1(b) and 2(b), making it easy to drill vias with a CO_2 laser, thus providing access to the inner wiring patterns (Fig.1(c) and 2 (c)). Two methods of forming the outer wiring patterns are illustrated. In Fig. 1, a new copper layer is then applied from which the outer wiring patterns are made. It can be seen in Fig. 1(d) that the new copper layer 7 is in contact with the alkaline refractory layer 2, the inner wiring pattern 10 and where it passes through the via, the copper layer contacts only the thermosetting resin layer 3. The

alkaline refractory metal was removed from the via 6 by the laser drilling. In Fig. 2, a resist is applied to the alkaline refractory metal 2 first and then copper layer 7 is added. In Fig.2 (e) it can be seen that the copper layer 7 again contacts the alkaline refractory layer 2, except at the sides of the vias 6. This multi-layer board is more definitely described in the amended Claim 10 and in new Claim 19. However, the method of the originally presented Claim 10 inherently produced such a board and the additional description only includes in the preamble of the claim the product of the method which has been recited.

Ito teaches a method of making multi-layer printed wiring boards in which through via holes are made by various means, which could include laser drilling, but did not include the alkaline refractory metal of the Applicants. To make the inner board, Ito drilled through a substrate and then filled the hole with a conductive paste, as shown in Fig. 8. After which, he added a layer of insulating material and made holes to provide access to the inner board circuits. Then, layers of copper were added and the outer circuits were formed. There is nothing in the method Ito proposed to make the outer wiring patterns which suggests the Applicant's methods. A layer of an alkaline refractory metal was not placed on the outer surface which was covered with the copper used to make the circuit patterns.

The method used by the Applicants to produce an improved multi-layer printed wiring board provides additional advantages. Not only does it make it possible to easily drill with a CO_2 laser when the thin layer of the alkaline refractory metal is on top of the thermosetting resin layer, but peel strength of the outer wiring circuits is improved. See Example 1 where a peel strength of 1.1 kgf/cm was demonstrated, as compared with only 0.3 kgf/cm when the alkaline refractory metal was not used. Furthermore, during the final etching of the outer circuit lines, the thin layer of the alkaline refractory metal is easily removed without the undercutting expected with thicker layers of metal. See page 14, lines 11-19 of the

specification. The Ito method could not produce wiring boards having these advantages, since it lacks a means of applying a thin layer of an alkaline refractory metal and does not recognize its advantages.

In view of the amendments above and the discussion of the differences between Ito's method and its product and the Applicant's method and product, the Examiner is asked to reconsider the rejection and to allow the claims as amended. If additional amendments are believed to be necessary, the Examiner is invited to contact the Applicant's attorney at the telephone number provided below.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Please replace the title on page 1, with the following new title and cross reference to related applications:

[Method For Producing] Multi-layer Printed Wiring Boards having Blind Vias

Cross-Reference to Related Applications

This application is a divisional of U.S. Patent Application Serial No. 09/229,225 filed January 12, 1999, issued as U.S. Patent No. 6,107,003.

In the Abstract:

Please replace the Abstract on page 25 with the following new Abstract.

ABSTRACT

A multi-layer printed wiring board having via holes is characterized by having the outer copper wifing circuit lines on a layer of an alkaline refractory metal which is adjacent to a thermosetting resin layer. An alkaline refractory metal which is insoluble is alkaline etching solutions, is electrodeposited on the surface of copper foil, then a thermosetting resin is applied to the surface and semi-cured to obtain a coated copper foil The coated copper foil is bonded to one or both faces of an inner layer board having wirings on one or both of its faces. Then, the copper foil on a surface of this laminate is removed by alkaline etching, while selectively leaving the alkaline refractor metal layer. A laser beam is used to form via holes in both the alkaline refractory metal layer and the thermosetting resin layer simultaneously. [With the above method,] [v]Via holes of the multi-layered printed wiring board can be easily formed using a laser, and adhesion between the outer wirings made from the plated copper and the insulating resin is improved.

In the Claims:

10. (Twice Amended) A multi-layer printed wiring board having via holes, wherein the outer wirings include copper as an outer layer and an alkaline refractory metal layer between the copper layer and a thermosetting resin layer and the via holes have a copper layer adjacent the thermosetting resin layer, and made by the method [of claim 1] comprising

(a) electrodepositing an alkaline refractory metal which can be dissolved in an acid etching solution on one surface of a copper foil;

(b) applying a thermosetting resin on the electrodeposited alkaline refractory metal of (a) and curing said resin to a semi-cured state, thereby producing a coated copper foil;

(c) bonding said coated copper foil of (b) to an inner layer board having inner wirings on one or both of the faces thereof, said thermosetting resin being laminated onto said inner layer board to form a multi-layer board;

(d) removing said copper foil from the multi-layer board of step (c) by etching with an alkaline etching solution; thereby leaving said alkaline refractory metal exposed;

(e) forming blind via holes in both the alkaline refractory metal and the thermosetting resin by directly irradiating said exposed alkaline refractory metal of (d) to remove the alkaline refractory metal and the thermosetting resin simultaneously with a CO_2 laser to form a multi-layer board in which via holes are formed; and

(f) forming outer wirings.

Please add the following new claim.

19. A multi-layer printed wiring board having via holes and outer wirings [in] on at least one outer surface of said board, wherein the outer wirings have two metal layers on a

thermosetting resin layer, the outer of said layers being of copper and the second of said layers being of an alkaline refractory metal, said via holes having a layer of copper on said thermosetting resin.